Space Weather Technical Forecast

Issued on Saturday 7 December 2024 at 12:17 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Low to Moderate solar activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Has been Low with a C7.8 flare peaking at 07/0859 UTC from AR3912 located in the southwest. There are eight active regions. The majority are small and simple, and none have shown significant changes. AR3912 has more developed magnetic complexity comprsising a main leader spot and a following spot with small intermediates in evidence. AR3916 in the southeast also appears to be comprised of a relatively small leader spot followed by simple trailers. AR3912 and AR3917 appear to be the most active regions on the disc, with AR3917 probably having a beta-gamma configuration. No Earth-directed CMEs were observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds, as recorded at L1, remained at slow-ambient levels, around 370 km/s. Density was initially below average before reach average to slightly above average levels. Total Interplanetary Magnetic Field (IMF), Bt, was mostly weak with a brief peak of 9nT at 07/0446 UTC, while the north-south component varied weakly between +6/-5nT. Phi angle was mostly negative (towards the Sun). Geomagnetic activity remained at Quiet levels (Kp 1-2).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels. The associated 24-hour fluence was below Active. The 07/0000UTC observation was 1.89e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected with a chance of isolated M-class flares.

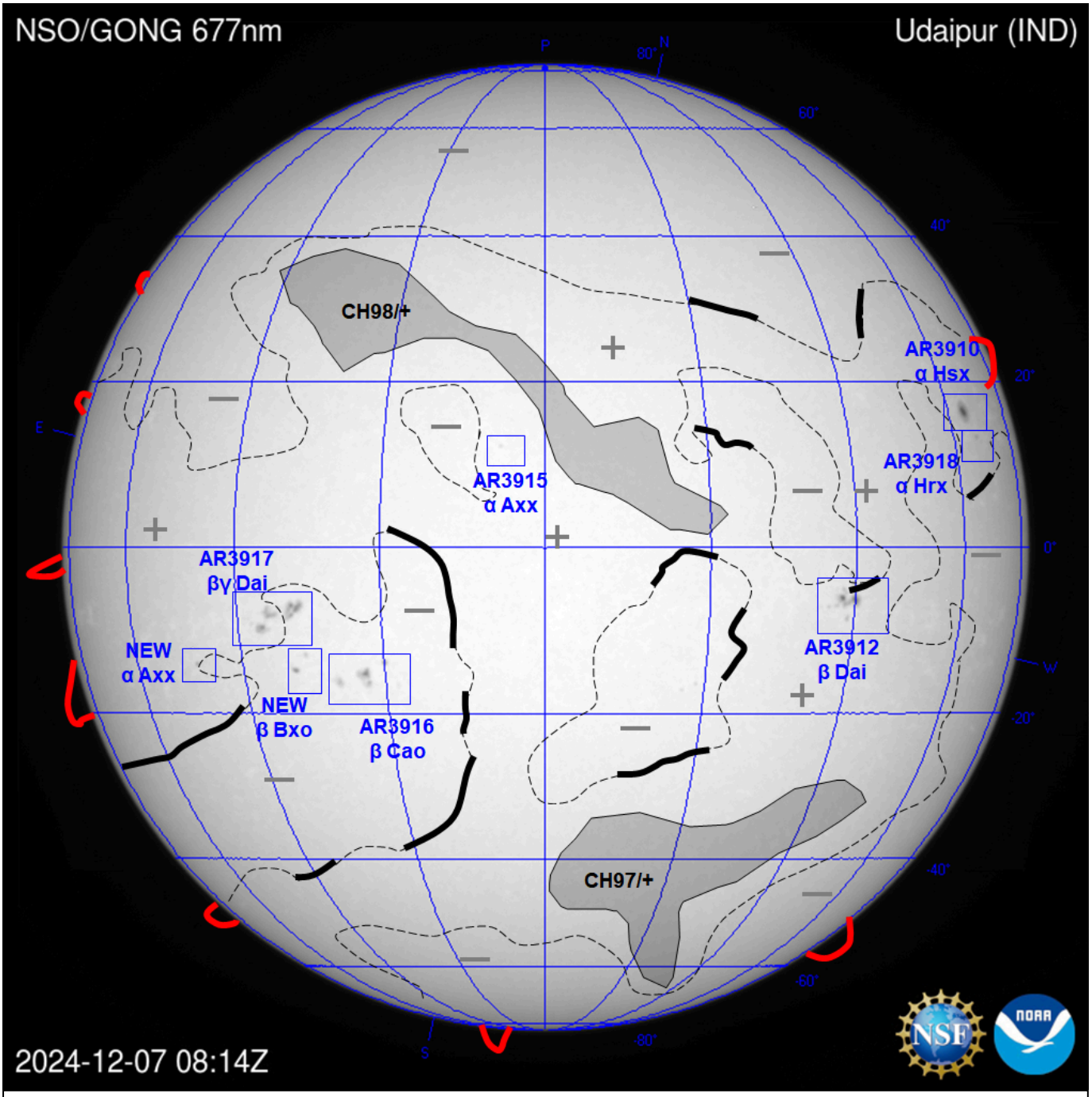
Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently expected. Background or perhaps occasionally slightly elevated solar winds are likely to continue until an expected connection to the fast wind from CH98/+ late on Day 3 (09 Dec), or perhaps into Day 4 (10th). Wind speeds of 450-500 km/s are probable. Overall mainly Quiet conditions at first, which may become Unsettled to Active by the end of Day 3 (09 Dec) or early Day 4 (10th).

Energetic Particles / Solar Radiation: High energy protons are expected to persist at background levels. High energy electron flux is also expected to persist at background levels, with the associated 24 hour fluence remaining below the Active threshold.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1: Met Office Solar Synoptic Map valid 07/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms

No Earth-directed CMEs are currently expected.

MOSWOC Enlil has recently had a weak connection to persistent CH97/+, but most of the HSS associated with CH97 has apparently gone to the south of Earth. This is supported by the previous rotation where solar wind reached just above 400 km/s, despite the coronal hole being located further north that time round. Background or perhaps occasionally slightly elevated solar wind speeds are likely to continue. A connection to the fast wind from CH98/+ is most likely on Day 3 (09 Dec), or perhaps early Day 4 (10th). The latest MOSWOC Enlil suggests a connection to this feature on 08 Dec, which is an improvement on previous runs which were bringing it in much too soon. This feature was present on the previous rotation, with the leading edge slightly further back than this time around, suggesting a faster onset than previously. However, wind speeds only reached just over 450 km/s last time so similar speeds of 450-500 km/s are likely. Confidence remains low for any notable geomagnetic activity however, as this is less favoured towards the solstices (Russell-McPherron effect).

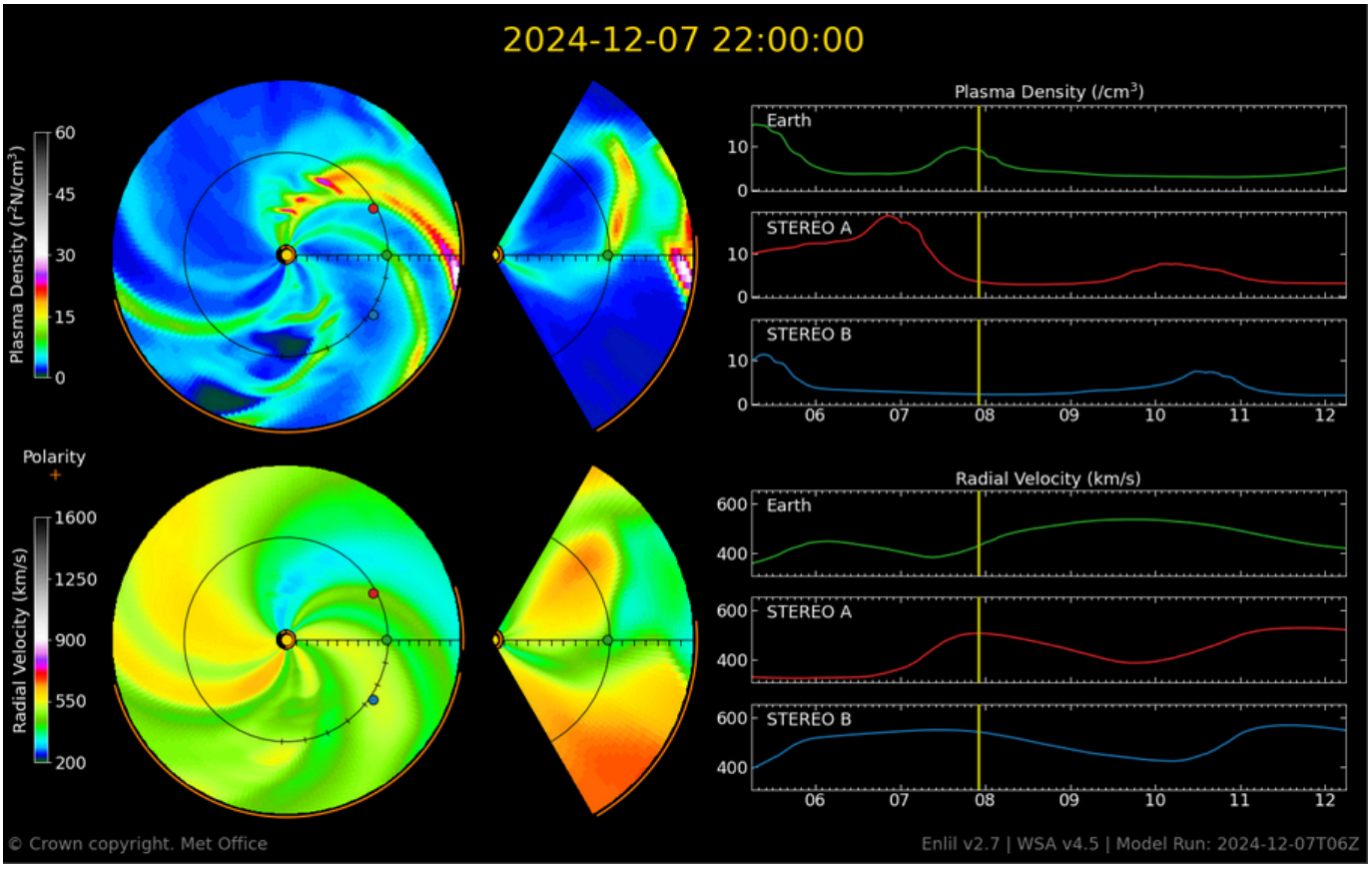
Quiet geomagentic activity at first, may become Unsettled to Active by the end of Day 3 (09 Dec) and also early on Day 4 (10th).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	0
Severe	G4	No	1	1	1	0
Extreme	G5	No	1	1	1	0

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: Met Office ENLIL output



© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares

There are eight active regions currently on the disc. The majority of the regions are small and simple, and none have shown any significant development. AR3912 in the southwest has displayed a degree of magnetic complexity, with a Dai/beta-gamma classification. AR3916 in the southeast appears to comprise of a relatively small spots with some development noted. AR3912 and AR3917 are probably the most active regions on the visible disc.

Far-sided products have no strong signals for returning groups from over the east limb, despite the potential for AR3904 and AR3898 to soon move back onto the disc. These may be related to some magnetic looping evident just over the southeast limb in GOES SUVI 195, while a further cluster of loops is evident in the northeast. Both these areas could be sources of oncoming activity.

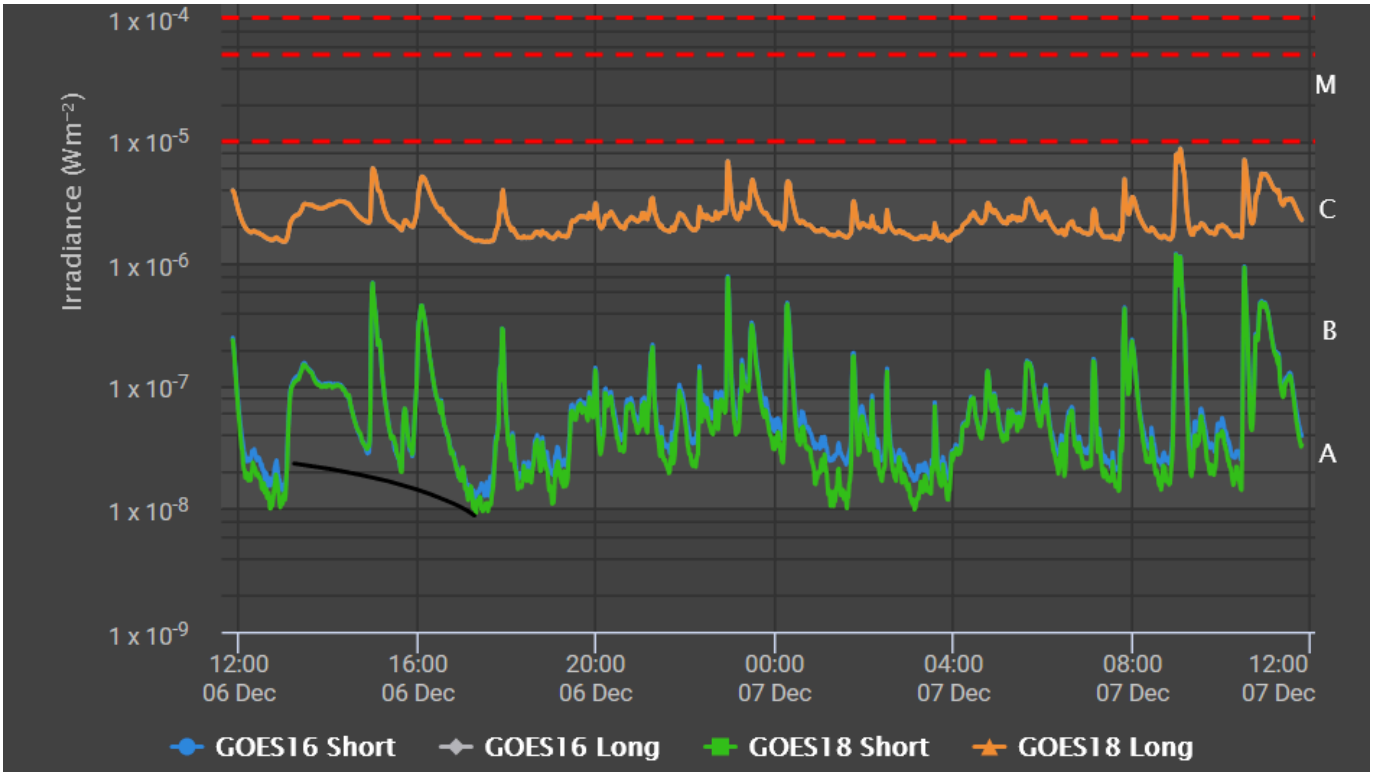
Low to Moderate activity is expected to continue with an ongoing chance of M-class flares.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	40	30	30	40
Very Active	R3-R5 (X Class)	No	5	5	5	5

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 3: GOES X-Ray flux from the past 24 hours.



© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

GOES18 proton flux is currently at background levels and is expected to remain at this level with the sunspot regions on the Earth-facing disc currently small and relatively simple.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons (≥ 2MeV)

High energy Electron flux observed by GOES16 has been predominantly at background levels. This is expected to persist for the majority of the forecast period, with no significant coronal hole or CME enhancements currently anticipated. Connection to the HSS may lead to electron flux reaching Moderate levels through Day 4 (10th).

The associated 24-hour fluence is expected to persist below Active levels, although a slight increase may occur later on Day 4 (10th). The initiation of the uplift in fluence as indicated by MOSWOC REFM is considered too early. However, overall the REFM is considered reasonable guidance, keeping the fluence below the Active threshold.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	10
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 4: High energy electron flux at GEO and latest MOSWOC REFM output.

© Crown Copyright 2024. All Rights Reserved.